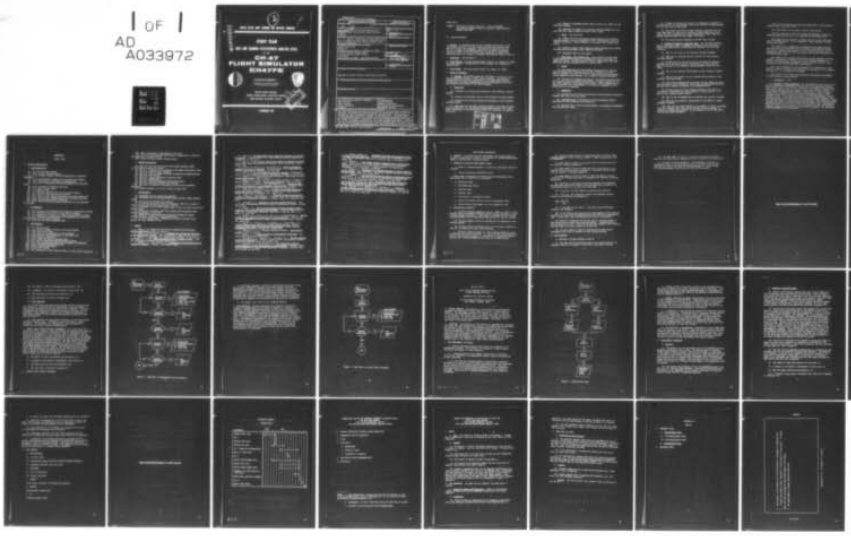
AD-A033 972 ARMY AVIATION CENTER FORT RUCKER ALA F/G 14/2
COST AND TRAINING EFFECTIVENESS ANALYSIS (CTEA) OF THE CH-47 FL--ETC(U)
DEC 76

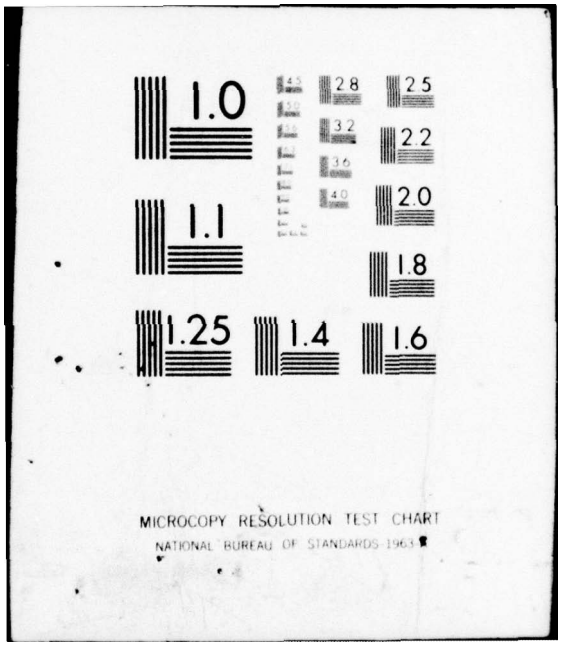
UNCLASSIFIED NL

1 OF 1
AD
A033972



END

DATE
FILMED
2-77


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

(2)

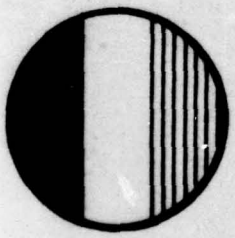
UNITED STATES ARMY TRAINING AND DOCTRINE COMMAND

STUDY PLAN

COST AND TRAINING EFFECTIVENESS ANALYSIS (CTEA)

OF THE

CH-47 FLIGHT SIMULATOR (CH47FS)



CH47FS STUDY GROUP
UNITED STATES ARMY AVIATION CENTER
FORT RUCKER, ALABAMA 36362

3 DECEMBER 1976

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: N/A	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle): Cost and Training Effectiveness Analysis (CTEA) of the CH-47 Flight Simulater (CH47FS).	5. TYPE OF REPORT & PERIOD COVERED: Study Plan
6. PERFORMING ORG. REPORT NUMBER: ACN 23879	
7. AUTHOR(s): CH47FS Study Group, US Army Aviation Center, Ft Rucker,AL; Study Sponsor's Representative: Mr. J. Toomepuu, US Army Training Support Center, Ft Eustis, VA 23604	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS: CH47FS Study Group, ATZQ-D-SG, US Army Aviation Center, Ft Rucker, AL 36362	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS: US Army Training Support Center, ATTSC-TD-OT, Fort Eustis, VA 23604 (804-878-4812/4813)	12. REPORT DATE: 3 Dec 1976
	13. NUMBER OF PAGES: 49 (12) 44p.
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)	15. SECURITY CLASS. (of this report): Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Cost and Training Effective Analysis	CH-47 Helicopter
Army training	Training devices
Pilot training	Transfer of training
Flight simulators	Army personnel and equipment
Aviation	Operational testing

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The CH47FS CTEA Study Plan presents the purpose of the study and the terms of reference, including the problem statement, the objectives, scope, limits and assumptions, and the Essential Elements of Analysis (EEA). The alternative training packages selected for analysis and the Measures of Training Effectiveness (MOTE) are defined. The support and resource requirements for the study are listed and control procedures and the study schedule established. Included are also the methodology for analyzing training effectiveness, the operational test plan for generating effectiveness data, and the methodology for cost analysis.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

408 849

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

ATZQ-D-SG-A

SUBJECT: Training Development Study Plan: Cost and Training Effectiveness Analysis (CTEA) of the CH-47 Flight Simulator (CH47FS) ACN 23879

TO: SEE DISTRIBUTION

1. Purpose. To determine the cost and training effectiveness of the CH47FS when utilized in the CH-47 Aviator Qualification Course (AQC) and CH-47 aviator unit training. The results of this study will be used to determine the USATRADOC position for the CH47FS Development Acceptance (DEVA) In Process Review (IPR) scheduled for October 1977. This study falls into category 1, Manpower and Personnel (DOD Dir 5010.22).

2. References. See Inclosure 1.

3. Study Sponsor. US Army Training Support Center, Ft. Eustis, VA 23604. The study sponsor's representative is Juri Toomepuu, DAC, AUTOVON 927-4812/4813/4218.

4. Study Agency. US Army Aviation Center, Ft. Rucker, AL 36362.

5. Terms of Reference.

a. Problem: The CH47FS program was undertaken to improve the cost and training effectiveness of CH-47 aviator training. The problem requiring resolution includes verification of the anticipated benefits, justification of further expenditures, and the optimization of the cost and training effectiveness of the CH47FS program.

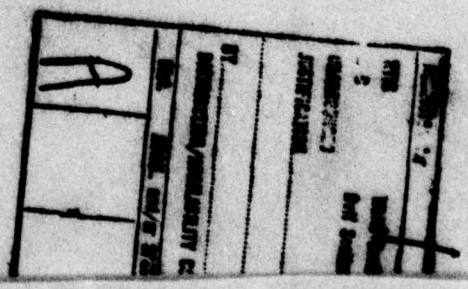
b. Objectives.

(1) Determine the training effectiveness of each alternate training package.

(2) Estimate the pertinent costs of each alternate training package.

(3) Determine the cost and training effectiveness of each alternate training package.

(4) Rank order the alternate training packages on the basis of appropriate quantitative cost and training effectiveness measures, and judgemental evaluations of the situations in which the alternates are expected to be used.



(5) Prepare a recommended CH47FS basis-of-issue plan (BOIP) for the preferred packages.

(6) Ascertain the impact each alternate training package will have upon Army-wide combat readiness of Army's CH-47 assets.

c. Scope. The study will:

(1) Address the cost and training effectiveness of the alternate training packages listed in paragraph 5i below, considering anticipated resource constraints, combat readiness of the Army's CH-47 assets, and safety.

(2) Include a review of the Synthetic Flight Training System (SFTS) Training Device Requirement (TDR), CARDS Ref No. 0027.

(3) Recommend a BOIP for the CH47FS.

d. Time frame: 1977 through 1986. This reflects the time frame of the Aviation Requirements for the Combat Structure of the Army III (ARCSA III) Study. See paragraph 5f(2) below. Beyond this time frame quantities and distributions of CH-47's are not firm.

e. Limits.

(1) Data supporting the effectiveness analyses will be obtained from the Developmental Test/Operational Test II (DT/OT II) of the CH47FS prototype, the office of the CH-47 Modernization Project Manager, Project Manager Training Devices, and a search of relevant literature.

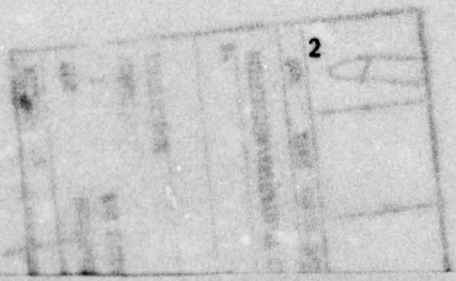
(2) The study will address the impact of the CH47FS (training device 2B31) on the cost and training effectiveness of aviator training and on the combat readiness of the Army's CH-47 assets. Other training devices and the relative cost-effectiveness of the separate components of the CH47FS will not be addressed.

f. Assumptions.

(1) Conclusions of the CH-47 Modernization Program Concept Formulation Package (CFP) (July 1975) are valid.

(2) Recommendations of the ARCSA III Study pertaining to CH-47 quantities and distributions will be approved.

(3) The draft CH-47 Aircrew Training Manual, as proposed by USAFORSCOM, will be approved by HQDA.



(4) Changes in doctrine and tactics for employment of medium lift helicopters will not significantly affect CH-47 aviator training throughout the time frame of this study.

(5) The state-of-the-art of flight simulator technology will continue improving, but there will be no major breakthroughs that would render the current generation of flight simulators or their major subsystems obsolete during the time frame of the study.

(6) The current ground training in the CH-47 AQC is valid.

g. Essential Elements of Analysis (EEA). The following questions must be resolved in order to achieve the purpose of the study and to address the implications of introducing the simulator into the Army inventory.

(1) What are the costs of the alternate training packages?

(2) What are the training costs per aviator for the alternate training packages?

(3) At what point in the life cycle of the alternate training packages (which include the use of the CH47FS) will their costs be equal to the costs of the baseline training packages (using the CH-47 only)?

(4) What is the training effectiveness of each alternate training package?

(5) What is the relative cost and training effectiveness of each alternate training package?

(6) What flight maneuvers and procedures (if any) cannot or should not be practiced in the simulator? What flight procedures and maneuvers (if any) can or should be practiced in the simulator only?

(7) To what extent will the training received by the aviator in the CH47FS be transferred to actual operation of the aircraft? (i.e., what is the training transfer ratio?)

(8) What is the recommended mix of simulator and aircraft training?

(9) What are the potential contributions of the CH47FS to combat readiness training?

(10) What are the safety benefits of the CH47FS, in terms of accident costs and casualty rates, that may be expected from less exposure of aviators to training in aircraft? (To be answered by the US Army Agency for Aviation Safety (USAAAVS)).

(11) For each year in the study time frame, what is the projected aviator input for the CH-47 AQC?

(12) What should be the basis of issue of the CH47FS?

(13) On the basis of cost and training effectiveness, should the CH47FS simulate the CH-47D? If so, what are the resulting costs?

(14) What are the technical, schedule, and cost risks associated with the CH47FS program? (To be answered by Project Manager, Training Devices (PM TRADE)).

(15) What are the reliability, availability, and maintainability characteristics of the CH47FS, and how do these characteristics affect the cost and training effectiveness of CH-47 aviator training? (To be answered by the US Army Aircraft Development Test Activity (USAADTA) and the CH47FS Study Group).

(16) What are the resource implications of each alternate training package, considering, in addition to the costs/benefits measured in dollars, the requirements for manpower, fuel, training airspace, areas, facilities, time, and environmental consequences?

(17) Can a reduction in cost be achieved by a modification of the CH47FS in light of maneuvers that should not be practiced in the simulator (see EEA 6)? (To be answered by PM TRADE).

(18) What are the flight standardization advantages/disadvantages of each alternate training package?

h. Constraints. None.

i. Alternate Training Packages. For the purpose of this study, CH-47 aviator training is categorized as either unit or institutional training. Unit training will be construed to include all CH-47 aviator training other than initial qualification or instructor pilot (IP) training, whether or not the unit training involves members of CH-47 units. Unit training includes aircrew re-qualification training (individual and unit), combat readiness flying (CRF), operational flying for training purposes, and proficiency flying. It excludes operational flying for mission support since such support can only be provided by actual aircraft (even though such flying may, and often will be credited against CRF minimums). Each training package includes the hardware on which training will be taught (i.e., the simulator and/or the CH-47) and the method of its utilization, as well as appropriate training literature providing instructions and/or guidance. The following training packages will be addressed:

(1) Institutional Training (IT).

(a) Use of the CH-47 only (baseline).

(b) Maximum use of the CH47FS supplemented by the CH-47 only for maneuvers and procedures that cannot be practiced or performed in the flight simulator.

(c) Use of the CH47FS and the CH-47, in accordance with a program of instruction (POI) determined by the study agency as study progresses.

(2) Unit Training (UT).

(a) Use of the CH-47 only (baseline).

(b) Maximum use of the CH47FS supplemented by the CH-47 only for maneuvers and procedures that cannot be practiced or performed in the flight simulator.

(c) Use of the CH47FS and the CH-47, in accordance with a POI determined by the study agency as study progresses.

j. Measures of Training Effectiveness (MOTE).

(1) Aviator performance evaluation scores.

(2) The hours of training necessary to attain the following performance objectives:

(a) Institutional Training (IT): To provide a CH-47 qualification course (transition) student with the skills necessary to enable him to successfully complete the aircraft type qualification examination (i.e., to achieve a minimum score of 70) under the meteorological conditions which allow for safe flight of the aircraft and permit performance of required maneuvers and skill demonstration.

(b) Unit Training (UT): To provide a CH-47 aviator with the practice necessary to maintain the skills required to successfully complete the aircraft examination ride (i.e., to achieve a minimum score of 70) under the meteorological conditions cited above.

(3) Other: To be developed by the study agency and approved by the study sponsor and/or Study Advisory Group (SAG).

k. Methodology.

(1) Selection of the preferred alternate will be made on the basis of a variable cost/fixed effectiveness analysis and military judgment.

(2) Effectiveness methodology (see Inclosure 2).

(3) Cost methodology (see Inclosure 3).

1. Models. Models will be identified by the study agency and used as needed.

m. Related Studies. See Inclosure 1.

6. Environment Threat Guidance: Threat application, as necessary, will be conducted using USATRADOC standard combat development scenarios IAW USATRADOC Regulation 71-4.

7. Support and Resource Requirements.

a. Support Requirements.

(1) HQ USATRADOC

(a) Provide guidance and assistance in development of methodology and collection of data.

(b) In conjunction with USAFORSCOM, furnish data on current and projected CH-47 aviator strengths and densities throughout the Army.

(2) HQ USAFORSCOM.

(a) Provide input as indicated in 7a(1)(b) above and other data as needed.

(b) Provide CH-47 qualified aviators for subjects in the unit training test.

(3) US Army Training Support Center.

(a) Establish and chair a SAG.

(b) Provide guidance to the study agency.

(4) US Army Transportation Center. As the proponent for the CH-47, provide information on force structure, organization, basis-of-issue and concept of operation.

(5) USATRADOC Coordinating Centers and Associated Schools and Centers. Provide data pertaining to the study, generated or collected by them in the course of carrying out their assigned mission and function.

(6) US Army Aviation Board. Provide assistance, guidance and data relative to the DT/OT II supporting the study.

(7) HQ USADARCOM (PM TRADE). Provide data essential to the conduct of the study (cost, performance, schedule, risk, RAM and others as requested).

(8) HQ USADARCOM (PM CH-47 Modernization Program). Provide data relative to aircraft production schedules, cockpit configuration, and other data impacting upon the CH47FS.

(9) US Army Research Institute. Provide the necessary consulting services throughout the conduct of the study.

(10) US Army Agency for Aviation Safety. Provide data and/or support to the safety analysis in the study.

(11) Comptroller of the Army. Provide cost data and/or validation of cost estimates as necessary.

(12) US Army Aviation Test Activity (PROV). Provide RAM data generated by the CH47FS Development Test (DT II).

(13) US Army Aviation Center and Fort Rucker.

(a) Provide the necessary administrative support to conduct the study.

(b) Prepare and submit statements of work and requests for contractual support, if required.

(c) Request data and/or assistance, as required, from the agencies listed above.

b. Resource Requirements.

(1) Participants in the study will be funded by their parent organizations.

(2) Automated Data Processing requirements will be identified by the study agency.

(3) The study agency will provide the study group members and physical facilities for the conduct of the study.

8. Administration:

a. Study Title. Cost and Training Effectiveness Analysis (CTEA) of the CH-47 Flight Simulator (CH47FS). Short title: CH47FS CTEA.

b. Study Schedule. See Inclosure 4.

c. Control Procedures. The following control procedures have been established by the study directive.

(1) A SAG will be established and chaired by the US Army Training Support Center IAW AR 5-5.

(2) The SAG will:

(a) Review the study plan and methodology and any statement of work or request for contractual support.

(b) Conduct reviews and evaluations of the study agency efforts and issue guidance as appropriate.

(c) Review and approve the draft final report prior to publication.

(d) The SAG will be composed of the Chairman and the Deputy Chairman, designated by the study sponsor, and a member of each of the following agencies:

(1) HQDA (DCSOPS)

(2) USAFORSCOM

(3) USADARCOM (PM TRADE)

(4) USAAVNC

(5) USATCFE

(e) Observers from interested agencies may be invited to attend SAG meetings at the discretion of the chairman or his deputy.

d. EEA Format. EEAs will be written in accordance with the format and guidance of Inclosure 5.

e. Approving Authority. The USATRADOC Deputy Chief of Staff, Training, has the approving authority for the study plan and the final report.

f. Action Documents. A proposed BOIP for the CH47FS will be prepared and submitted as part of the study report.

g. Coordination and Other Communication. The study agency is authorized direct communication with all DA agencies below HQDA.

h. Distribution.

(1) Ten copies of the study plan and the final report will be submitted to the study sponsor. In addition, copies will be furnished to

agencies IAW the distribution for the study directive, plus 12 copies of the study report to the Defense Documentation Center (DDC), two copies to the Defense Logistics Study Information Exchange (DLSIE), and a copy to the Army Library in the Pentagon.

(2) Interim and draft reports will be distributed to the study sponsor and the members of the SAG only.

i. Security Classification Guidance. See Appendix F, USATRADOC Pam 71-3 and AR 380-5.

9. Correlation:

a. USATRADOC Action Control Number: ACN 23879.

b. Points of Contact:

(1) USATRADOC POC is the Study Sponsor's representative.

(2) Study agency POC is CPT Thomas C. Mowdy, Jr., AUTOVON 558-6316/5418.

Gorman

PAUL F. GORMAN
Major General, GS
Deputy Chief of Staff
for Training
HQ TRADOC

5 Inclosures
1. References
2. Effectiveness Methodology w/Tabs A & B
3. Cost Methodology
4. Milestone Schedule
5. Generalized Outline for EEA

DISTRIBUTION:
See next page

CF:
HQDA (DALO-AV)
(DAMA-WSA)
(DAMA-RAC)
(DAMA-CSS)
(DAMO-RQD)
(DAMO-RQZ)
(DACA-CAZ)
(DUSA-OR)
(DAMO-ODA)
(DACA-CAM)
CINCUSAREUR (AEAGC-T)
(ATFE-LOAE)
Cdr TRADOC (ATDCG)
(ATCD-CM-C)
(ATCD-AO)
(ATCD-D)
(ATCD-T)
(ATORI-AV)
(ATTNG)
(ATTNG-EA)
(ATTNG-PRD)
(ATTNG-ITD)
(ATTNG-TDD)
(ATTNG-TMI)
DARCOM (DRCPA-S)
(DRCPM-TND-AV)
FORSCOM (AFOP-AV)
USAAVNC (ATZQ-TD-TAD-A)
(ATZQ-D)
(ATZQ-D-MT)
(ATZQ-D-SG)
(ATZQ-T-GIT)
(ATZQ-T-RTM)
AVSCOM (DRCPM-CH47M)
USACAA (MOCA-SAP)
USAMSAA
USAAVS (IGAR-AR)
(IGAR-TA)
USAADTA (STEBG-B)
(STEBG-TS)
(STEBG-PD)
USAIMA (ATSH-CTD)
TCATA
USARI
USASA (IAOPS-AV)
USAMSC (MSA-CDB)
USAARL
USALC (ATCL-SCA)
CACDA (ATCA-CCM)
USAICS (ATZB-DPT)
(ATSH-I-V)
USAARMS (ATCK-TD)
USAFAS/C (ATSF-TD)
USATCFE (ATSP-DT)
(ATSP-CD)
USALOGC (ATCL-CC)
(ATCL-SCA)
USAISC (ATTSC)
(ATTSC-TD)
(ATTSC-TP)
(ATTSC-IT)
(ATTSC-CT)
(ATTSC-LO)
USAOC&S (ATSL-CTD)
USASCS (ATSN-TD)
USATRASANA (ATAA-TA)
EUSA
Cmdt USAADS (ATSA-TD)
(ATSM-TD)
Dir USARI Fld Unit, Ft Rucker, AL
Pres USA Avn Bd, Ft Rucker, AL
DDC
DLSIE
Army Library, Pentagon

REFERENCES

CH47FS CTEA

1. Military Publications

a. Army Regulations

(1) 5-5, The Army Study System
(2) 11-8, The Cost Analysis Program
(3) 37-13, Economic Analysis and Program Evaluation of Resource Management.
(4) 37-38, Weapon/Support Systems Cost Categories and Elements
(5) 70-1, Army Research, Development and Acquisition
(6) 70-10, Test and Evaluation During Development and Acquisition Cycle.
(7) 70-31, Standards of Technical Reporting
(8) 71-2, Basis of Issue Plans
(9) 71-3, User Testing
(10) 71-7, Military Training Aids and Training Aid Centers
(11) 71-9, Materiel Objectives and Requirements
(12) 95-1, Army Aviation: General Provisions and Flight Regulations
(13) 95-63, Army Aviation Standardization and Instrument Training
(14) 380-5, Safeguarding Defense Information
(15) 1000-1, Basic Policies for Systems Acquisition by the Department of the Army.

b. DA Pamphlets

(1) 11-2, Research and Development Cost Guide for Army Materiel Systems
(2) 11-3, Investment Cost Guide for Army Materiel Systems
(3) 11-4, Operating and Support Cost Guide for Army Materiel Systems
(4) 11-5, Standards for Presentation and Documentation of Life Cycle Cost Estimates for Army Materiel Systems
(5) 11-25, The Life Cycle Management Model

c. Field Manuals.

(1) 1-1, Terrain Flying
(2) 1-15, Aviation Company, Battalion, Group and Brigade
(3) 1-51, Rotary Wing Flight
(4) 1-55, Guide for the Operation of Army Airfields
(5) 1-60, Army Air Traffic Management in the Combat Zone
(6) 1-105, Aviator's Handbook
(7) 10-13, Supply and Service Reference Data
(8) 21-6, How to Prepare and Conduct Military Training
(9) 55-1, Army Transportation Services in a Theater of Operations
(10) 55-15, Transportation Reference Data
(11) 57-35, Airmobile Operations
(12) 61-100, The Division
(13) 90-1, Employment of Army Aviation Units in a High Threat Environment

Incl 1

(14) 100-5, Operations of Army Forces in the Field
(15) 101-10-1, Staff Officers Field Manual: Organizational, Technical, and Logistical, Unclassified Data
(16) 101-20, US Army Aviation Planning Manual

d. TRADOC Publications

(1) Reg 11-8, Cost and Operational Effectiveness Analysis (COEA) in the Materiel Acquisition Process
(2) Reg 71-3, Acceptance and Assignment of New Combat Development Tasks
(3) Reg 71-4, TRADOC Standard Scenarios
(4) Reg 71-6, Contract Support Policies, Procedures and Administration
(5) Reg 71-9, User Testing
(6) Reg 702-1, Combat Development Program for RAM
(7) Pam 11-8, COEA Handbook
(8) Pam 71-3, Combat Developments Study Writing Guide
(9) Pam 71-8, Analyzing Training Effectiveness
(10) Pam 350-8, Interservice Procedures for Instructional Systems Development
(11) TRADOC Supplement 1 to AR 71-2, Basis of Issue Plan

e. Miscellaneous

(1) AMC/TRADOC Materiel Acquisition Handbook
(2) USATRASANA Cost and Training Effectiveness Analysis (CTEA) Handbook (Draft)
(3) The Army Force Planning Cost Handbook
(4) DA Approved Qualitative Materiel Requirement (QMR) for a Synthetic Flight Training System (SFTS)(Rotary Wing), TDR 027.
(5) Development Plan for SFTS (Rotary Wing), Volume III, CH-47 Operational Flight Trainer
(6) Medium Lift Helicopter (MLH) CH-47 Modernization Program Concept Formulation Package, 14 July 1975
(7) ARTEP 57-55, Army Training and Evaluation Program for Combat Aviation Battalion (Infantry and Airborne Division).
(8) Air Force Master Plan: Simulators for Aircrew Training, Final Report, Dec 1975, ASD/XR-TR 75-25.

2. Studies

a. Adams, J. A. Research and the future of Engineering Psychology. American Psychologist, 1972, 27, 615-622.
b. Adams, J. A. and McAbee, W. H. A Program for a Functional Evaluation of the GAM-83 Melpar Trainer. USAF: APGC-TN-61-41, Eglin AFB, FL, Oct 1961
c. Bryan, G. L. and Regan, JJ. Training System Design. In Van Cott, H. P. and Kinkade, R. G. (Ed.) Human Engineering Guide to Equipment Design. (Rev. ed.) Washington: Government Printing Office, 1972.
d. Campbell, D. T. and Stanley, J. C. Experimental and Quasi-Experimental Designs for Research. Chicago: Rand McNally, 1963.

e. Caro, P. W. Equipment-Device Task Commonality Analysis and Transfer of Training. Technical Report 70-7, Human Resources Research Organization, Alexandria, VA, June 1970.

f. Caro, P. W. Some Factors Influencing Transfer of Simulator Training. Third Flight Simulation Symposium Proceedings, Royal Aeronautical Society, London, 1976.

g. Caro, P. W. Isley, R. N., and Jolley, O. B. Mission Suitability Testing of an Aircraft Simulator. Technical Report 75-12, Human Resources Research Organization, Alexandria, VA, June 1975.

h. Caro, P. W. Aircraft Simulators and Pilot Training. Professional paper 6-74, Human Resources Research Organization, Alexandria, VA, May 1974.

i. Gagne, R. M. Training Devices and Simulators: Some research issues. American Psychologist, 1954, 9, 95-107.

j. Gagne, R. M., Foster, Harriet, and Crowley, Miriam E. The Measurement of Transfer of Training. Psychological Bulletin, 1948, 45, 97-130.

k. Greer, G. D., Smith, W. D., and Hatfield, J. C. Improving Flight Proficiency Evaluation in Army Helicopter Pilot Training. Technical Report No. 77, Human Resources Research Office, Alexandria, VA, May 1962.

l. Isley, R. N. and Miller, E. J. The Role of Automated Training in Future Army Flight Simulators. Technical Report 76-27, Human Resources Research Organization, Alexandria, VA. August 1976.

m. Jacobs, R. S. and Roscoe, S. N. Simulator Cockpit Motion and the Transfer of Initial Flight Training. Technical Report ARL-75-18/AFOSR-75-8, Aviation Rsch Laboratory, Institute of Aviation, Univ of IL, Savoy, IL, Nov 1975.

n. Jeantheau, G. G. Handbook for Training Systems Evaluation. Technical Report NAVTRADEVCEN 66-C-0113-2, Naval Training Device Center, Orlando, FL, Jan 1971.

o. Koonce, J. M. Effects of Ground-Based Aircraft Simulator Motion Conditions upon Prediction of Pilot Proficiency. Technical Report ARL-74-5/AFOSR-74-3, Aviation Rsch Laboratory, Institute of Aviation, Univ of IL, Savoy, IL, April 1974.

p. Mackie, R. R., Kelley, G. R., Moe, G. L., and Mecherikoff, M. Factors Leading to the Acceptance or Rejection of Training Devices. Technical Report NAVTRAEQUIPCEN 70-C-0276-1, Naval Training Equipment Center, Orlando, FL, August 1972.

q. Meister, D., Sullivan, D. J., Thompson, E. A., and Finley, D. L. Training Effectiveness Evaluation of Naval Training Devices. Part II: A Study of Device 2F66A (S-2E Trainer) Effectiveness. Technical Report NAVTRADEVCEN 66-C-0113-2, Orlando, FL, January 1971.

r. Murdock, B. B., Jr. Transfer Design and Formulas. Psychological Bulletin, 1957, 54, 313-326.

s. Osgood, C. E. Method and Theory in Experimental Psychology. New York: Oxford University Press, 1953.

t. Povenmire, H. K., Alvares, K. M., and Damos, D. L. Observer-Observer Flight Check Reliability. Technical Report LF-70-2, University of Illinois Institute of Aviation, Savoy, IL, October 1970.

u. Povenmire, K. H. and Stanley, R. N. The Incremental Transfer Effectiveness of a Ground Based General Aviation Trainer. Technical Report ARL-72-9/AFOSR-72-4, Aviation Rsch Laboratory, Institute of Aviation, Univ of IL, Savoy, IL, May 1972.

14

v. Roscoe, Stanley, N. Incremental Transfer and Cost Effectiveness of Flight Training Simulators. Technical Report ARL-74-9/AFOSR-74-5, Aviation Research Laboratory, Institute of Aviation, Univ of IL, Savoy, IL, August 1974.

w. Toomepuu, J. Army Flight Simulator Programs From the User's Viewpoint. Paper presented at Topical Review, Training Devices and Flight Simulators, Office of Director of Defense Research and Engineering, Washington, D. C, 12 May 1976. AD A029266

x. Toomepuu, J. Determining the Cost-Effectiveness of Flight Simulator Motion Systems. Paper presented at the Second DOD/NASA Simulation Technology Meeting, Moffett Field, CA, 21 July 1976.

y. Toomepuu, J. Are Our Military Training Simulator Requirements Valid? Presentation at the American Institute of Aeronautics and Astronautics Visual and Motion Simulation Conference, Dayton, OH, 27 Apr 1976.

z. US Army Aviation Test Board, Final Report, Expanded Service Test UH-1H Field Unit Subsystem of Synthetic Flight Training System (SFTS) (Device 2B24), Ft Rucker, AL, April 1974.

aa. Williges, R. C., Hopkins, L. O., and Rose, D. J., Effects of Aircraft Simulator Motion Cue Fidelity on Pilot Performance. Technical Report ARL-75-11/AFOSR-75-4, Aviation Rsch Laboratory, Institute of Aviation, Univ of IL, Savoy, IL, June 1975.

EFFECTIVENESS METHODOLOGY

1. PURPOSE. To identify the data requirements and the methodology to be used in computing the values of the measures of training effectiveness (MOTE) of the alternate training packages.

2. MEASURES OF TRAINING EFFECTIVENESS (MOTE).

a. Hours of training necessary to attain the performance objective criteria.

b. Aviator performance evaluation scores.

3. These items of data will be collected in the Developmental Test/ Operational Test II (DT/OT II) of the CH47FS:

a. Trials per task.

b. Performance per trial.

c. Time per trial.

d. Time per task.

e. Total hours of training per aviator.

f. Aviator performance score per task on examination rides.

g. Overall aviator performance score per examination ride.

4. INSTITUTIONAL TRAINING.

a. Alternate training packages 1a and 1b. Number of hours of training and aviator performance evaluation scores will be collected for these training packages in DT/OT II. The values of the MOTE for each of these training packages will be determined using the DT/OT II data as follows:

(1) The mean number of hours of training will be computed for each training package.

(2) The mean aviator performance score on the aircraft examination ride will be computed for each training package.

b. Alternate training package 1c. This training package is a mix of simulator and aircraft training. The actual mix will be determined as DT/OT II data becomes available. A description of the analysis used in defining this training package and the value of its MOTE follows:

Incl 2

(1) The mean number of hours to train each task to criteria using training packages 1a and 1b will be computed. These training hours will be designated:

A_C = Mean number of hours to train the task to criteria using only the aircraft (training package 1a).

S_E = Mean number of hours to train the task to criteria or to the highest practical proficiency attainable in a reasonable time, by using only the simulator (training package 1b).

A_E = Mean number of hours (if any) to train the task to criteria in the aircraft following S_E hours of training in the simulator (training package 1b).

(2) Selection of tasks more effectively learned in the simulator and tasks more effectively learned in the aircraft will be based on the relationship between A_C, S_E, and A_E for each task.

(3) If $A_E \geq A_C$, the task should be learned in the aircraft.

(4) If $A_E < A_C$, the cumulative transfer effectiveness function (CTEF) for the task will be computed as:

$$CTEF = \frac{A_C - A_E}{S_E}$$

(a) If the CTEF for the task > 1, the task is more effectively learned in the simulator.

(b) If the CTEF for the task ≤ 1, the effectiveness of the simulator is equal to or less than the effectiveness of the aircraft in learning the task. In this case, other determining factors must be considered.

(5) The mix of simulator and aircraft time in training package 1c will evolve from the above task selection process. Training package 1c will be defined in terms of tasks more effectively learned in the simulator and tasks more effectively learned in the aircraft.

(6) The mean number of hours of training and the mean aviator performance score will be computed for this training package.

5. UNIT TRAINING.

a. Alternate training packages 2a and 2b.

(1) The mean aviator performance score on the initial aircraft examination ride will be computed to establish a proficiency baseline.

(2) The mean number of hours of training and the mean performance scores on the final aircraft examination will be computed as in paragraph 4a.

b. Alternate training package 2c. The methodology described in paragraph 4b will be used in defining the mix of simulator and aircraft time and the value of the MOTE for training package 2c. DT/OT II data for training packages 2a and 2b will be used in the analysis.

THIS PAGE INTENTIONALLY LEFT BLANK

Tab A to Incl 2

CH-47 FLIGHT SIMULATOR TRANSFER OF INSTITUTIONAL TRAINING TEST PLAN

Prepared by Dr. Garvin L. Holman

US Army Research Institute Field Unit
Fort Rucker, Alabama 36362

1. GENERAL OVERVIEW. The objective of this study is to experimentally determine the transfer of training from the CH-47 Flight Simulator (CH47FS) to the CH-47 aircraft. The experimental and control subjects will be aviators from the regular CH-47 Aviator Qualification Course classes. Aviators will be trained in the simulator to performance criteria, then tested and retrained as necessary in the aircraft. The basic data will be the savings in training accomplished by using the simulator compared to training in the aircraft only. See Figure 1 for a flow chart of the entire study.

2. OBJECTIVES. The objective of this study is to experimentally determine the extent that institutional training in the CH47FS will transfer to the operation of the CH-47 aircraft. The transfer of training will be measured on a maneuver by maneuver or task by task basis. The transfer of training data will allow decisions to be made concerning the improvement of the simulator, improvement of simulator and aircraft training programs and the determination of the cost-effectiveness of the simulator in a training program.

3. PRE-EXPERIMENTAL ACTIVITIES.

a. There are many tasks to be accomplished before the experimental program begins. The following is a discussion of some of these pre-experimental activities.

b. A program of instruction and flight training guide must be developed for use in the CH47FS and in the CH-47 by the experimental group. This training program will be a modification of the current CH-47 training guide that applies to institutional training in the aircraft. Changes that will be made in the present program will be to allow flight instructors to take advantage of the unique training capabilities of the simulator. The simulator has demonstration programs, checkride programs, and capabilities for demonstrating a student's performance, evaluating a student's performance and changing the training situation or location abruptly without having to spend valuable training time flying an aircraft from one place to another. The training guide specifies each maneuver and task

Tab A to Incl 2

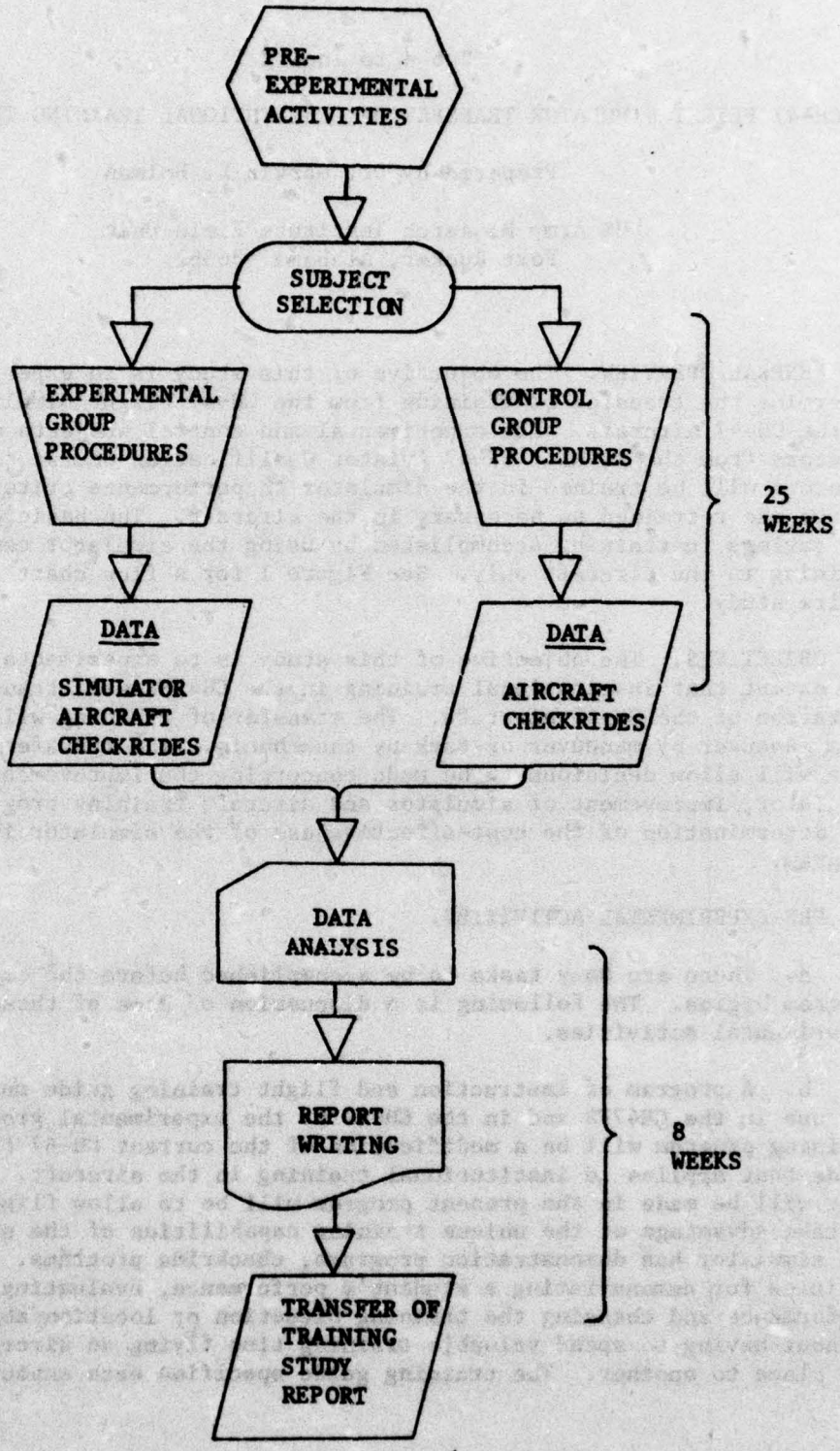


Figure 1. Overview Flow Chart.

to be taught and practiced in detail with the exception of the simulator-unique features. The same training guide will be used by the aircraft only training group.

c. Each maneuver will be defined in objective terms small enough to be meaningful in the evaluation but large enough to be graded by an instructor pilot or observer. For example, a landing could be broken down into very small tasks such as movements of the cyclic, thrust control, rudder pedals, and other activities, or the maneuver of landing could be broken into larger segments such as approach to base leg, turn to final, final approach and touch down, or the landing maneuver could be considered as a whole. The definitions of maneuvers and tasks will define them in an optimal manner to maximize the value of the experimental data and to make them operationally meaningful and easy for an instructor to objectively grade.

d. Evaluation criteria are spelled out alongside the flight training guide mentioned above. These criteria specify the precision with which each task or maneuver is to be performed. It is these criteria that the subjects will be trained against in the simulator and the aircraft and will be tested against in all checkrides.

e. New grading sheets for use in daily training and checkrides will be developed based on the maneuver and task definitions and the performance criteria developed above. These grading sheets will be used routinely throughout the test.

f. An IP/student opinion survey will be developed to assess IP and student opinions of the simulator. The subjects covered will include the simulator hardware, simulator operational characteristics, the training program, and the special training features.

g. Before the transfer of training study begins the CH47FS must be declared ready for training. This means that the acceptance test procedures have been completed and that there are no major deficiencies that will affect training in the simulator.

h. The instructor pilots (IPs) selected for participation in the simulator phase of the transfer of training study will be given a two-week course in the operation of the simulator by the simulator manufacturer. It is expected that five instructor pilots from the Aviation Center and two instructor pilots from USAFORSCOM will participate in this course. The course will be an introduction to the CH47FS that will teach the IPs how to operate the simulator and to use the instructor's control console in the simulator cockpit.

i. Following the simulator manufacturer's two-week IP course there should be a two-week Experimental Procedures Course provided by the

transfer of training study personnel to familiarize the IPs with the experimental procedures and materials being used. This familiarization will include the modified program of instruction and the use of all the training aids available in the simulator. The IPs will also have to be trained in the training and evaluation criteria to be used in the training program, the maneuver and task definitions developed and the use of the specialized grading sheets. This will also provide an opportunity for the IPs to use one another and perhaps others as test students in practicing training procedures in the simulator.

j. The IPs that will be teaching the control group will have to take a portion of the Experimental Procedures Course. They must know the program of instruction, the maneuver and task definition, the training and evaluation criteria and the use of the specialized grading sheets.

k. Lastly, there is a vast amount of coordination that must be done to insure that all phases of the program proceed on schedule. Local units that coordination must be accomplished with include the Test Board, the Directorate of Combat Developments, the Directorate of Training Developments, the US Army Research Institute, the Department of Graduate Flight Training and perhaps others.

4. EXPERIMENTAL PROCEDURES. The following general specifications of the program of experimentation describe the major variables to be controlled, the general procedures to be used in data gathering, the nature of the data to be collected and the methods of data reduction, analysis and interpretation. It does not include step-by-step directions for the detailed management of the experimental program as these will be developed as the program matures. Supplemental material such as the training guides with maneuver and task definition, performance criteria and grading sheets will appear as appendices to this test plan.

a. Subjects.

(1) The subjects for this study, both experimental and control, will all come from the dozen or so student aviators in the normal Department of the Army CH-47 Aviator Qualification Course classes that will be going on at the time of the study. Four subjects will be selected from each class as the experimental simulator training subjects. They will be selected on the basis of their prior flight experience and other criteria so as to prevent biasing the test due to undue concentrations of inexperienced or experienced aviators being used. Those students in the class not selected as experimental subjects will be the subjects in the control group that receive aircraft training only.

(2) The four subjects from each class will receive the normal academic training during one-half of the day and the simulator or aircraft training during the other half of the day. With overlapping classes the CH47FS

will be in use eight hours per day. The test program will use 24 subjects (6 classes) and is anticipated to run 25 weeks from the start of subject training.

b. Simulator Training Procedures.

(1) Subjects will be trained on tasks and maneuvers in the CH47FS in the same order as those tasks and procedures are trained in the aircraft as specified in the training guide. Training in the simulator will proceed until an acceptable criterion of performance is reached. That is, training in the simulator will not be stopped or continued according to time. Training will proceed until a subject can perform the task or maneuver to the criteria set out in the flight training guide. In the event that an aviator does not learn a particular task or maneuver in the simulator, training will be stopped when it is evident that further improvement is unlikely. This will prevent undue time being spent in the attempted training of skills at which the simulator is inefficient. Details of these procedures will be taught to the IPs in the Experimental Procedures Course before the start of the experiment.

(2) During the course of training, performance data will be recorded by the IPs on each task and maneuver. The experimental grade sheets will be used and the data will include the task or maneuver being practiced, a measure of the student's performance on each trial and the time devoted to each maneuver. The use of the grade sheet and the performance measures will be taught in the Experimental Procedures Course. To maintain quality control in data collection each IP will be periodically monitored and retrained in the experimental procedures as required.

(3) The last phase of simulator training will be a checkride in the simulator over all the maneuvers trained in the simulator. Any maneuver not performed to criteria in the checkride but earlier trained to criteria will be retrained and retested.

(4) From time to time during training and at the conclusion of the simulator checkride the IPs and students will take the opinion survey. This will allow the determination of trends of opinion changes and may help to emphasize good and bad features of the simulator or the training program.

(5) At the end of the simulator training phase of the experiment the following data elements will have been collected for each subject and each task or maneuver, numerically designated as indicated:

(a) The number of times each maneuver was practiced. (1)

(b) A measure of the student's performance on each trial. (2)

(c) The time spent practicing each maneuver. (3)

(d) A listing of those tasks or maneuvers that could not be learned to criterion. (4)

(e) The total time of simulator training. (5)

(f) A measure of the student's performance in a simulator checkride on each task or maneuver. (6)

c. Simulator Group Aircraft Checkride. At the completion of simulator training the simulator trained subjects will go directly to the aircraft for an aircraft checkride. They will not do preflight or other procedures nor will they have any familiarization time in the aircraft. The purpose of this checkride is to determine which of the tasks and maneuvers taught in the CH47FS need no further training in the aircraft and which ones do require additional training in the aircraft. The checkride will cover all those maneuvers that were taught in the simulator and will be done to the standards of performance required in the simulator training. The same grade sheets and performance criteria will be used. At the end of this checkride a measure of the student's performance on each task or maneuver in the aircraft after only simulator training will have been collected (7).

d. Simulator Group Aircraft Training

(1) The simulator trained group will have two phases of aircraft training; one to enable us to assess the training value of the simulator, and a second to train the qualification students on those maneuvers and procedures for which the trainer was not designed.

(2) The first phase of aircraft training will cover those tasks and maneuvers that the subjects were unable to pass on the checkride just completed in the aircraft. These tasks and maneuvers will be trained to criterion just as they were in the CH47FS. The same training guide, maneuver definitions, performance criteria and grading sheet will be used. The same data that was collected in the simulator will be collected in the aircraft. When these tasks and maneuvers are trained to criterion, the transition subjects may progress to the second phase.

(3) In the second phase the qualification subjects will be taught those tasks and maneuvers not covered in the simulator training. Such operations include water and slope operations, preflight procedures and, perhaps, others. These maneuvers and procedures will also be taught to a criterion performance level just as all previous training has.

(4) At the end of aircraft training the following additional data will have been collected for each maneuver not adequately learned in the CH47FS:

(a) The number of times each maneuver was practiced. (8)

(b) A measure of the student's performance on each trial. (9)

(c) The time spent practicing each maneuver. (10)

(d) The total time of aircraft training. (11)

e. Final Checkride.

(1) At this point the qualification student should be ready for the final checkride. Checkrides will be administered in the same manner as the previous checkrides and the same data will be collected. Failure in any maneuver will require more training and another checkride. At the conclusion of this checkride a measure of the student's performance on each task or maneuver in the aircraft after aircraft training will have been collected. (7)

(2) This completes the experimental procedures for the experimental (simulator trained) group. See Figure 2 for a flow chart of these procedures. The following is a description of the experimental procedures for the control (aircraft trained) group.

5. CONTROL GROUP AIRCRAFT TRAINING PROCEDURES. The control group will receive all of its training in the aircraft and no training in the simulator. The aircraft training will be identical to that the experimental group receives in the simulator in that training will be performed to the same criterion standards and the same type data will be collected. The training guide of the simulator training program will be used but without reference to the simulator-unique training features. The same maneuver definitions, performance criteria and grading sheets will be used. The control IPs will require training in these procedures and will have to attend part of the Experimental Procedures Course. The training will also include those tasks and maneuvers not taught in the simulator which are normally part of the CH-47 Aviator Qualification Course. At the end of control group training the following data will have been collected for each control subject and each task or maneuver:

a. The number of times each maneuver was practiced. (8)

b. A measure of the student's performance on each trial. (9)

c. The time spent practicing each maneuver. (10)

d. The total time of aircraft training. (11)

6. CONTROL GROUP AIRCRAFT CHECKRIDE.

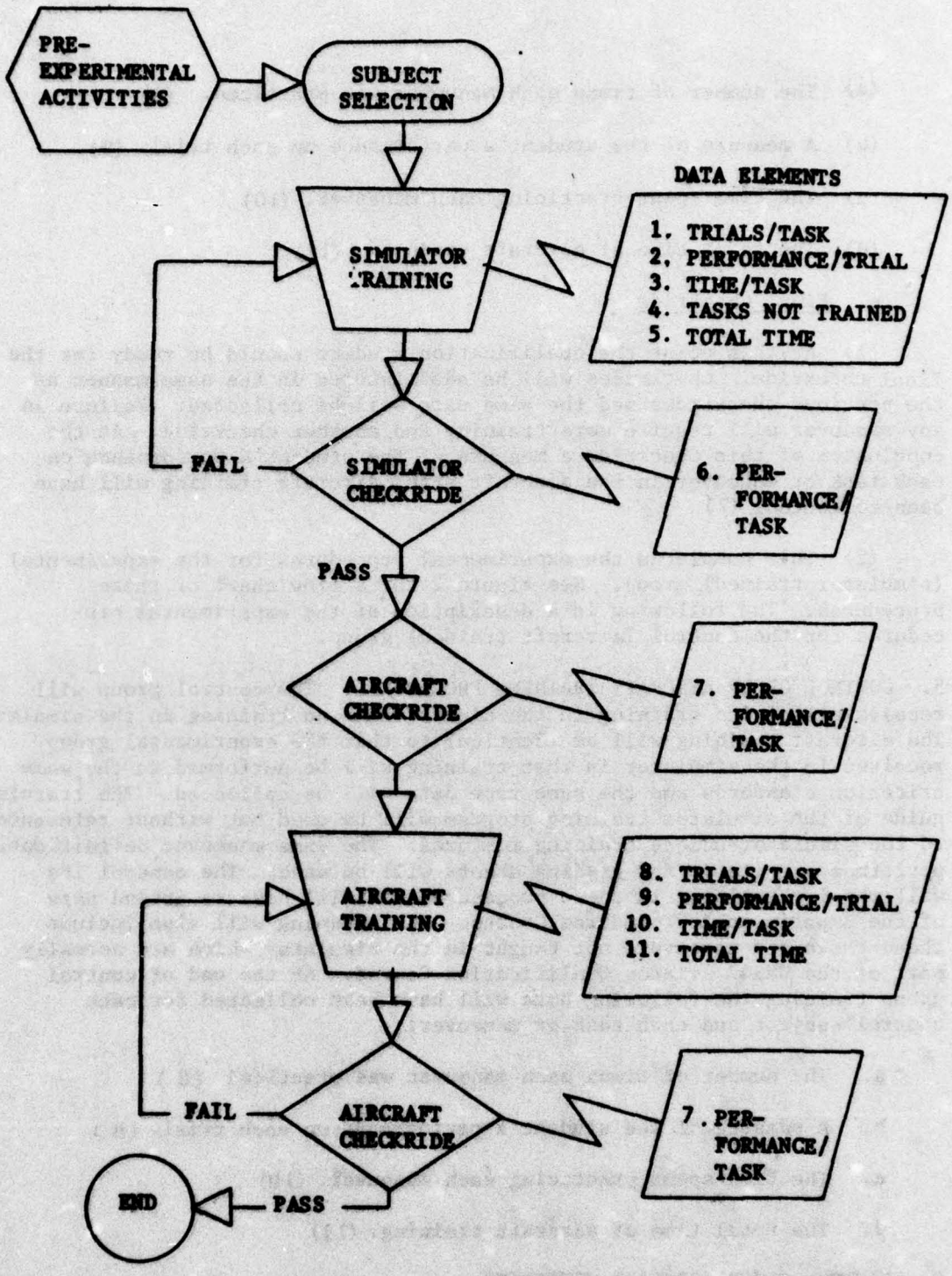


Figure 2. Flow Chart of Experimental Group Procedures.

a. Following training to criterion in the aircraft, the control group will receive a checkride identical to the final aircraft checkride designed for the simulator trained group. If a student does not pass this checkride he will receive more training and another checkride until he can pass it. Data will be collected in this further training and checkride just as it was collected in the original training and checkride. Additional data collected will be a measure of the student's performance on each task or maneuver in the aircraft after only aircraft training (7).

b. See Figure 3 for a flow chart of these procedures.

7. DATA REDUCTION. The data collected can be reduced to measures of transfer of training such as the percent of transfer of training or cumulative transfer effectiveness ratios for each task and maneuver that was trained in the simulator. These data will allow the determination of which tasks and maneuvers transfer most effectively from the training received in the simulator to the final performance expected in the aircraft. From such figures conclusions may be drawn concerning the improvement of the simulator, improvement of the simulator and aircraft training program, and the determination of the cost-effectiveness of the use of the simulator in institutional training program. In addition to the data mentioned above, there will be considerable data of an opinion nature derived from both the instructor pilots and the students that participated in the experiment.

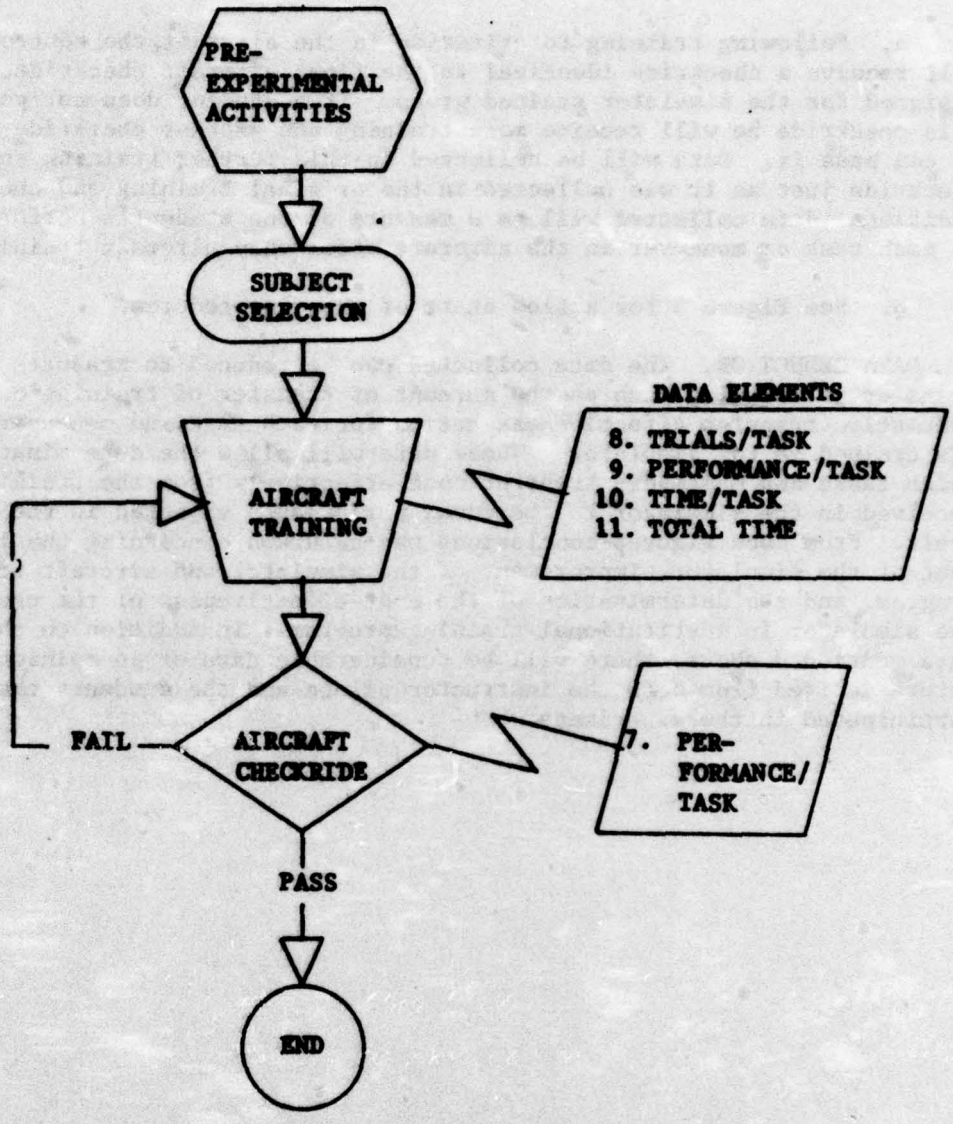


Figure 3. Flow Chart of Control Group Procedures.

Tab B to Incl 2

CH-47 FLIGHT SIMULATOR TRANSFER OF UNIT FLYING TRAINING TEST PLAN

Prepared by Dr. Garvin L. Holman

US Army Research Institute Field Unit
Fort Rucker, Alabama 36362

1. GENERAL OVERVIEW. The objective of this study is to experimentally determine the maintenance of unit flying in the CH-47 Flight Simulator (CH47FS). The experiment involves the training of a group of aviators for six months in the CH47FS, and at the end of that time, testing them in the aircraft. The control group with similar training and testing in the aircraft will be run for comparison purposes. See Figure 1 for a flow chart of the entire study.

2. OBJECTIVE. The objective of this study is to experimentally determine the extent that unit flying skills trained in the CH47FS will be maintained and transfer to the aircraft. The determination will be made on a maneuver by maneuver or task by task basis of maneuvers and tasks that can be performed both in the CH47FS and the aircraft. Such an experimental analysis of the maintenance of proficiency will allow decisions to be made concerning improvements in the simulator, improvement of any training program in which the simulator is a part, and a determination of cost-effectiveness of the simulator in a unit flying training program.

3. PRE-EXPERIMENTAL ACTIVITIES.

a. Several preparations must be made before the beginning of the experimental program. The following is a discussion of some of these activities and reasons for their necessity.

b. A training guide for unit flying training must be developed that will be followed by the experimental subject aviators participating in this experiment.

c. At the time the training program is being devised, maneuvers and tasks to be included in the program, and against which the performance of the aviator will be judged, will be carefully defined. This will insure that all aviators have explicit information as to the maneuvers and tasks they are to perform and the manner in which they should be performed. Such control of training is essential to obtain valid test information.

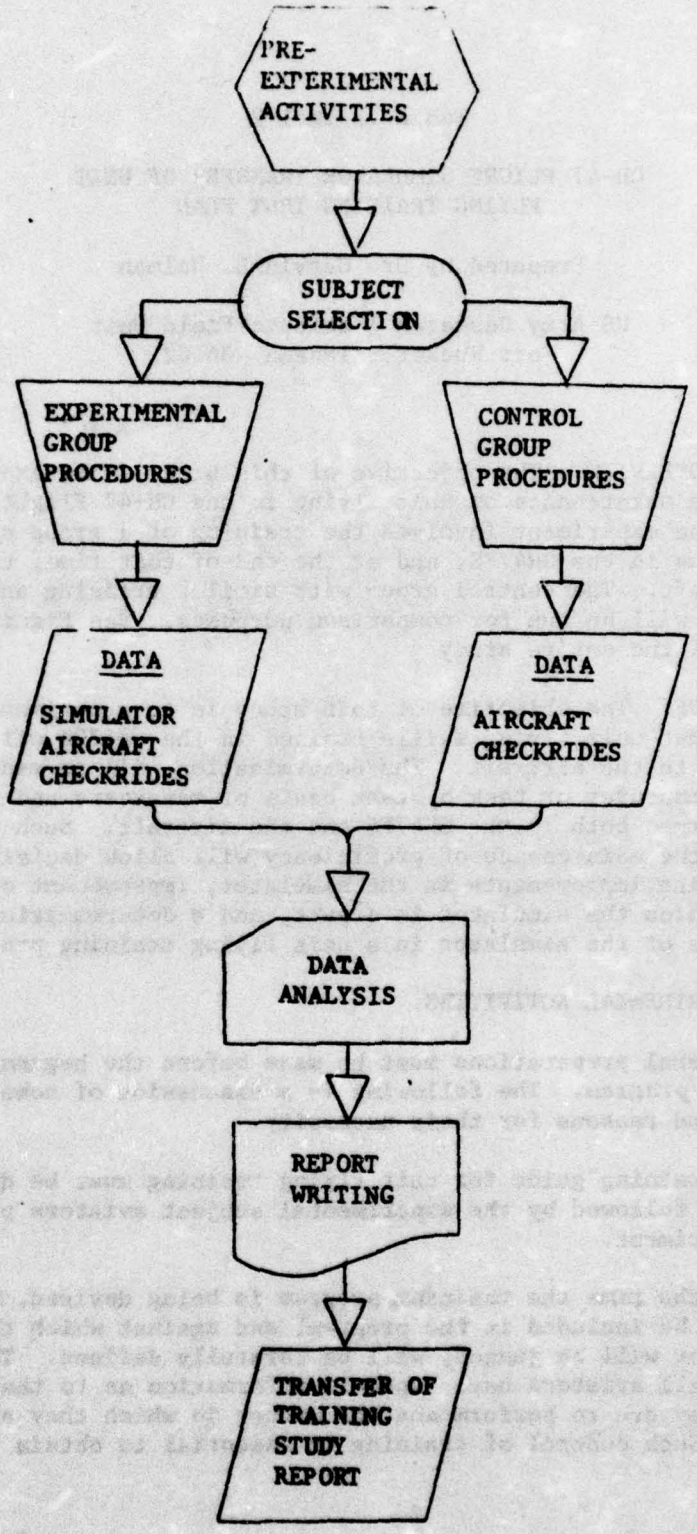


Figure 1. Overview Flow Chart

d. Closely related to the above activity is the determination of the criteria against which aviator performance will be evaluated. These criteria will not only be used in evaluation phases of the program but in the training phases in that these are the criteria to which aviators will be trained to perform.

e. Equally important and again interrelated to the above activities is the development of grading sheets. These sheets will be used in day to day training activities and in the evaluation phases of the program. They will insure that a uniform method is used to evaluate aviators' performance on the various maneuvers and tasks and that the data is all in the same form and readily available for evaluation.

f. In addition to these activities, another very important activity is that of coordination. Coordination will be necessary between various units at Fort Rucker such as the Test Board, Directorate of Training Developments, Directorate of Combat Developments, US Army Research Institute, Department of Graduate Flight Training, and perhaps others. Activities at Fort Rucker will have to be coordinated through various units and USAFORSCOM which is expected to provide instructor pilots (IPs, and aviator subjects for this test program.

g. IPs will have to be assigned to participate in this flight simulator test program at Fort Rucker. These IPs will go through a two-week course in which they learn how to operate the simulator and use it as a training device followed by another two-week course in which they learn the desired training guide, the maneuver and task evaluation criteria, and how to train to criteria and evaluate the subject aviators.

4. EXPERIMENTAL PROCEDURES.

a. Subjects.

(1) The subjects for this experiment will be 16 USAFORSCOM aviators assigned to operational CH-47 units. The subjects must be carefully chosen against several criteria. They must be available to participate in the study for six months from the start date. They and their unit must be willing for them to stop all their flying activities during this six-month period except for essential CH-47 missions and for the simulated flying received in the program. They must also be free to come to Fort Rucker once a month for a few days to participate in the simulation training program.

(2) The control group subjects will be 16 USAFORSCOM aviators very much like the simulator group subjects. They must be willing and able to participate in the experiment for six months, including not flying any aircraft except the CH-47 on essential missions.

b. Simulator Training Program.

(1) Each of the 16 subject aviators will come to Fort Rucker for a two or three-day period one week out of every four. Prior to coming, each subject will have taken a checkride in the CH-47 aircraft identical to the one that will be given at the end of the program. This will establish a proficiency baseline against which the results of further training can be compared. At the end of the initial checkride a measure of the subject's performance on each task or maneuver in the aircraft before specific training in the CH47FS will have been collected (7).

(2) On each two or three-day period, the subjects will receive five hours of flight instruction and practice in the CH47FS so that at the end of six months each subject will have accumulated a total of 30 hours of training in the simulator. The training will not be conducted on an hourly basis but to a performance criterion. The training guide will specify the maneuvers to be trained on and practiced, but the training of a particular task or maneuver will not take place for a particular period of time. Instead, the training will continue until the aviator can perform the task or maneuver to a predetermined criteria. In the event that an aviator does not learn a particular task or maneuver in the simulator, training will be stopped when it is evident that further improvement is unlikely. This will prevent undue time being spent in the attempted training of skills at which the simulator is inefficient. At this point the training will continue on another task or maneuver. In this way subject aviators will maintain their flying proficiency in all tasks and maneuvers expected in the CH-47 aircraft.

(3) Data will be collected in the simulator covering the number of times that each task or maneuver was practiced, an evaluation of the subject aviator's performance of each task or maneuver, and the time spent in practicing that task or maneuver.

(4) The last phase of simulator training will be a checkride in the simulator over all the maneuvers trained in the simulator. Any maneuver not performed to criteria in the checkride but earlier trained to criteria will be retrained as time allows. At the end of the simulator phase of the experiment the following data will have been collected for each subject and each task or maneuver:

(a) The number of times each maneuver was practiced. (1)

(b) A measure of the subject's performance on each trial. (2)

(c) The time spent practicing each maneuver. (3)

(d) A listing of those tasks or maneuvers that could not be learned to criterion. (4)

(e) The total time of simulator training. (5)

(f) A measure of the student's performance in a simulator checkride on each task or maneuver. (6)

(g) The time each aviator flew the CH-47 aircraft and the types of missions and maneuvers flown. (12).

c. Simulation Group Aircraft Checkride. At the end of the six-month period, each of the 16 aviators will receive a checkride in the CH-47 aircraft. This checkride will cover all the essential procedures that were practiced in the simulator. The data from this checkride will consist of evaluations of the subject aviator's performance on each task or maneuver requested of him in the checkride (7). Additional data collected at this stage will be a measure of each student's performance on each task or maneuver in the aircraft after six months of CH47FS training. This completes the experimental procedures for the experimental (simulator trained) group. See Figure 2 for a flow chart of these procedures. The following is a description of the experimental procedures for the control group.

d. Control Group Training. The initial event in the control group will be a checkride in the aircraft identical to those given the experimental group. Each subject will then fly only essential CH-47 missions. No other flying will be allowed.

e. Control Group Checkride.

(1) The control group will take a checkride identical to that described above for the simulation group. The same data will be collected. See Figure 3 for a flow chart of control group procedures.

(2) The data to be collected are:

(a) Initial performance measures of each maneuver in an aircraft checkride. (7)

(b) Performance measures of each maneuver in the final aircraft checkride. (7)

(c) The time each aviator flew the CH-47 aircraft and the types of missions and maneuvers flown. (12)

5. DATA REDUCTION. The data from the training procedures and testing procedures above will be reduced to percent transfer of training and cumulative transfer effectiveness of the simulator in training the various combat readiness flying tasks and maneuvers. From this reduced data suggestions will be made for improvement of the simulator, improvements in training programs using the simulator, and a determination of the cost-effectiveness of training programs using the simulator.

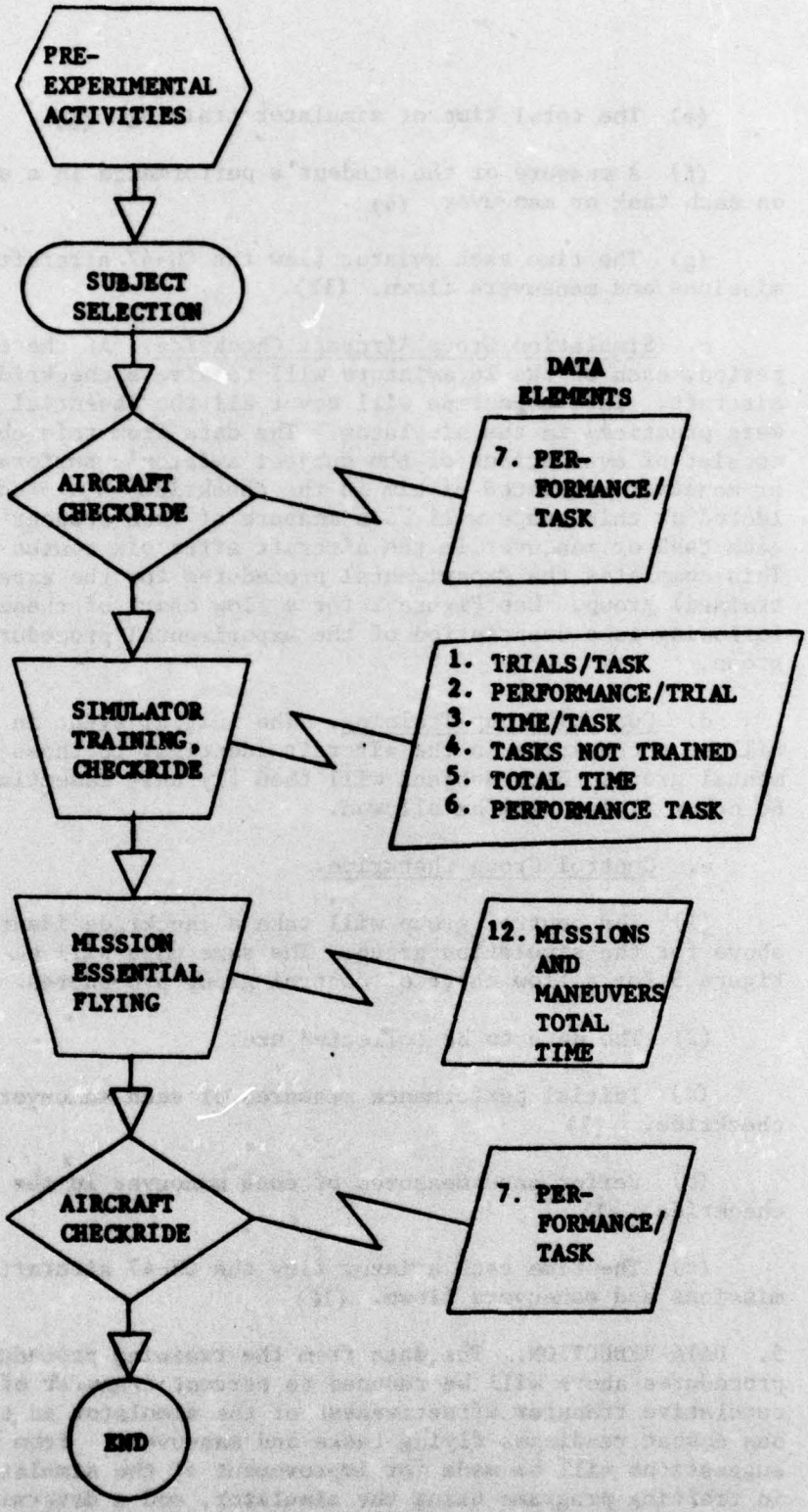


Figure 2. Flow Chart of Experimental Group Procedures.

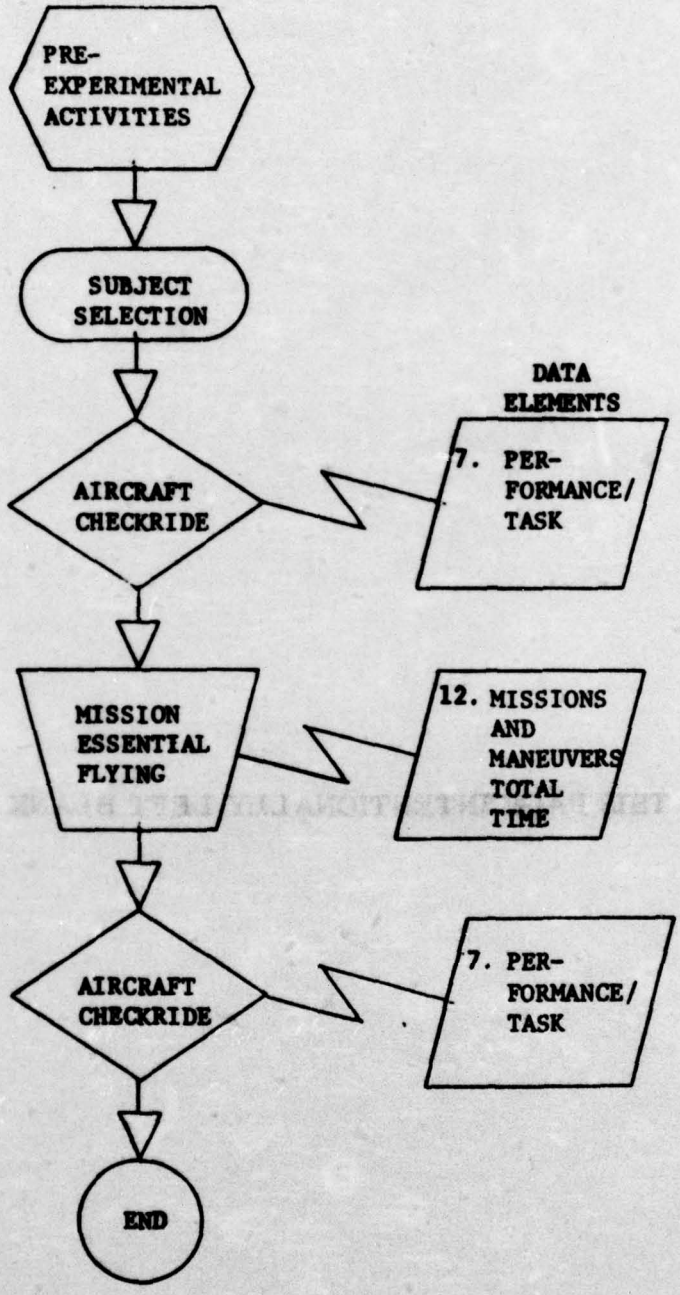
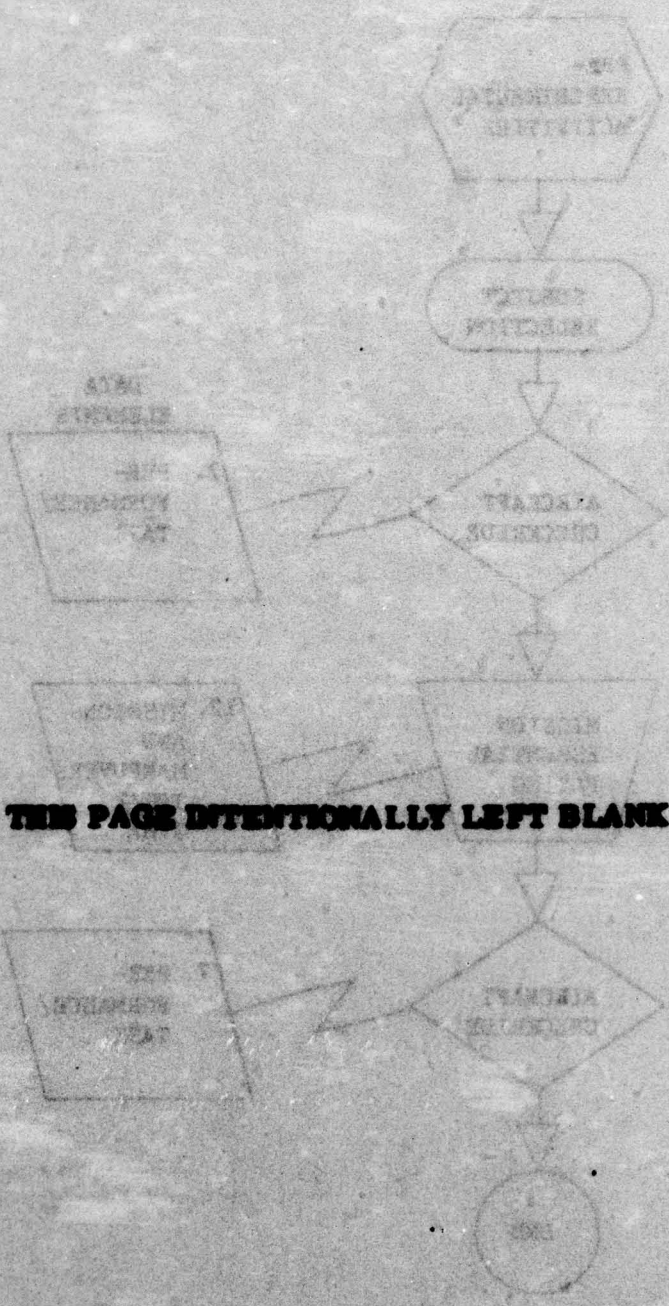


Figure 3. Flow Chart of Control Group Procedures.



THIS PAGE INTENTIONALLY LEFT BLANK

Inclosure 3

COST ANALYSIS METHODOLOGY

1. PURPOSE. To identify the data requirements and the methodology to be used in determining the pertinent costs of the alternate training packages. The cost analysis is designed to answer (wholly or in part) the following EEA:

a. What are the costs of the baseline training packages for the time frame of the study?

b. What are costs of the alternate training packages which employ the CH47FS for the same period?

c. What are the training costs per aviator for the alternate training packages?

d. What are the safety benefits of the CH47FS, in terms of accident costs and casualty rates, that may be expected from less exposure of aviators to training in aircraft?

e. What are the technical, schedule, and cost risks associated with the CH47FS program?

f. Can a reduction in cost be achieved by a modification of the CH47FS in light of maneuvers that should not be practiced in the simulator?

2. GROUND RULES.

a. All costs incurred through FY 77 will be considered as sunk costs and will be identified as such, but will not be included in life cycle cost estimates (LCCE).

b. LCCE for the CH47FS will be developed in accordance with AR 11-18 and DA Pam 11-2, 11-3, 11-4, 11-5.

c. Flight Simulator (FS) LCCE will be developed for buy sizes of one to ten units. Additional LCCE will be computed on larger buy sizes, if required, during the course of the study.

d. A 15-year operating life (1977 - 1991) will be used to develop LCCE for the CH47FS.

e. Future purchases of CH-47C and CH-47D aircraft for training purposes will be considered. Procurement cost of previously (before FY 78) purchased training aircraft will be considered sunk.

Incl 3

f. Operating and Support (O&S) costs will be computed based on annual operating hours of 2000 through 4000 hours.

3. METHODOLOGY.

a. There are two types of training packages to be addressed, institutional training (IT) and unit training (UT). The alternate training packages are:

(1) Institution training.

(a) Use of the CH-47 only (IT baseline),

(b) Maximum use of the CH47FS supplemented by the CH-47 only for maneuvers and procedures that cannot be practiced or performed in the flight simulator.

(c) Use of the CH47FS and the CH-47, in accordance with a program of instruction (POI) determined by the study agency as study progresses.

(2) Unit training.

(a) Use of the CH-47 only (UT baseline),

(b) Maximum use of the CH47FS supplemented by the CH-47 only for maneuvers and procedures that cannot be practiced or performed in the flight simulator.

(c) Use of the CH47FS and the CH-47, in accordance with a program of instruction (POI) determined by the study agency as study progresses.

b. The cost of each alternate training package will be determined as follows (the same basic equation is applicable for both institutional (IT) and unit training (UT):

(1) Training Cost per Aviator for i^{th} Alternate

Training Package = tc_i

tc_i = Hrs . Cost/Hr + Hrs · Cost/Hr
AC AC FS FS

(2) Total Cost for i^{th} Alternate

Training Package = TC_i

TC_i = No. of Aviators · tc_i

c. To support the above, the following subanalyses will be conducted:

(1) LCCE will be developed for the FS for buy sizes of one to ten units. Additionally, the modification cost of converting a CH47FS from a CH-47C to a CH-47D aircraft simulator will be determined.

(2) LCCE (adjusted to FY 78 dollars) for those CH-47C and CH-47D to be purchased for training will be determined.

(3) Scheduling, technical, and cost risks associated with the CH47FS will be identified, and their impact upon costs will be addressed.

d. In addition to the analyses described in paragraph 3b and c above, a side analysis will be conducted to determine the safety benefits in terms of costs and casualties avoided to be accrued by training in the CH47FS in lieu of the CH-47 aircraft. This analysis will be requested from the US Army Agency for Aviation Safety (USAAAVS).

4. DATA SOURCES.

a. OCOA/USADARCOM

(1) FS and AC LCCE

(2) Modification costs of CH-47C to CH-47D aircraft simulator

(3) Schedule, technical, and cost risks

b. USAFORSCOM

(1) Unit training data

(2) Aviator densities

c. USAAAVS

CH-47 safety, accident, and flying hour analyses

d. USAAVNC

Institutional training data

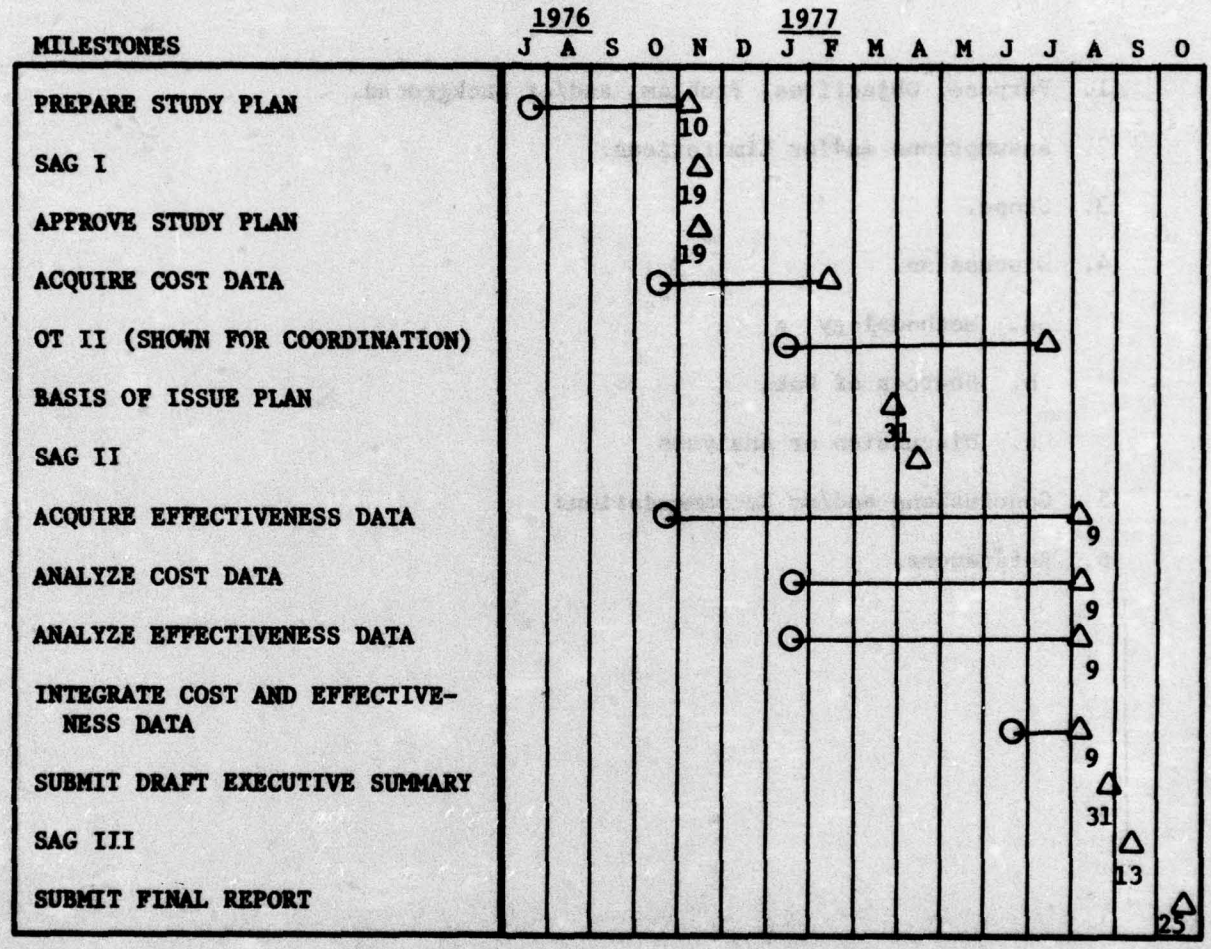
e. DA

Projected student loads

THIS PAGE INTENTIONALLY LEFT BLANK

MILESTONE SCHEDULE

CH47FS CTEA



Encl 4

GENERALIZED OUTLINE FOR ESSENTIAL ELEMENTS OF ANALYSIS (EEA)
FOR THE FINAL REPORT
CH-47 FLIGHT SIMULATOR (CH47FS)
COST AND TRAINING EFFECTIVENESS ANALYSIS (CTEA)

1. Purpose, Objectives, Problem, and/or Background.

2. Assumptions and/or Limitations.

3. Scope.

4. Discussion.

   a. Methodology

   b. Sources of Data

   c. Discussion or Analysis

5. Conclusions and/or Recommendations

6. References.

NOTES: 1. Each abbreviation, acronym, term used and its meaning, as well as each reference cited, is to be furnished on a 3" X 5" card in the format prescribed by USATRADOC Pamphlet 71-3.

2. Paragraphs 1, 2, and 3 cited above are to be used only as needed.

3. The EEA is to be written per the following pages.

FORMAT PAGE NUMBERING, AND SOME RULES OF STYLE FOR
EEA IN THE FINAL REPORT,
CH-47 FLIGHT SIMULATOR (CH47FS)
COST AND TRAINING EFFECTIVENESS ANALYSIS (CTEA)

1. FORMAT.

a. Text. The format for an EEA is shown in attachment 1. Assignment of appendices to EEA will be announced by the study agency as study progresses.

b. Figures.

(1) All graphic or tabular information supportive to the text will be labeled as figures. That is, there will be no "graphs," "illustrations," "tables," etc.

(2) Each figure will be no less than one page and will immediately follow the page on which it is first cited.

(3) The format for figures is shown in attachment 2.

(a) The figures in the executive summary and main report will be numbered consecutively with arabic numerals.

(b) Figures in appendices will also be numbered consecutively with arabic numerals preceded by the letter of the appendix and, as applicable, the roman numeral of the annex, the lower case letter of the inclosure, and the arabic numeral of the tab in which the figure appears. E.g., reading this figure number from right to left, "Figure M-I-b-3-5" denotes that this is the fifth figure of tab 3 of inclosure b to annex I of appendix M.

2. PAGE NUMBERING. All pages will be numbered, including those of figures.

a. Executive Summary and Main Report. Pages of the executive summary and main report will be numbered consecutively with arabic numerals.

b. Appendices.

(1) Pages contained in appendices will be numbered consecutively with arabic numerals preceded by the letter of the appendix and, as

applicable, the roman numeral of the annex, the lower case letter of inclosure, and the arabic numeral of the tab in which it is located.

(2) For each appendix, annex, inclosure, and tab, the text always begins on the 3d page; the 2d page is left blank; and the 1st page is the title page.

3. SOME RULES OF STYLE.

a. Abbreviations and Acronyms.

(1) The executive summary, main report and appendices are to be written to stand alone without recourse to the study glossary. Therefore, acronyms and abbreviations are to be defined where they first appear in the text. Only the acronyms and abbreviations will be used in subsequent pages, annexes, inclosures, and tabs.

(2) If an abbreviation or acronym will appear only once in the text, it shall not be used.

(3) All agencies will receive their full title and be accordingly abbreviated, e.g., "US Army Training and Doctrine Command (USATRADOC)", not "US Army Training and Doctrine Command (TRADOC)" or "US Army Research Institute (USARI)" not "US Army Research Institute (ARI)".

b. Numbers.

(1) Cardinal numbers of ten or less will be written, e.g., "nine simulators", but "13 aircraft".

(2) Ordinal numbers will be expressed with numerals, e.g., "2d place" and "The alternate ranks 6th."

c. Percent. The word "percent" will always be used in the text in lieu of "%".

APPENDIX ZZ

EEA 39

1. PARAGRAPH TITLE.

a. Subparagraph Title.

(1) Sub-subparagraph Title.

(2) Sub-subparagraph Title.

b. Subparagraph Title.

2. PARAGRAPH TITLE.

.
.
.

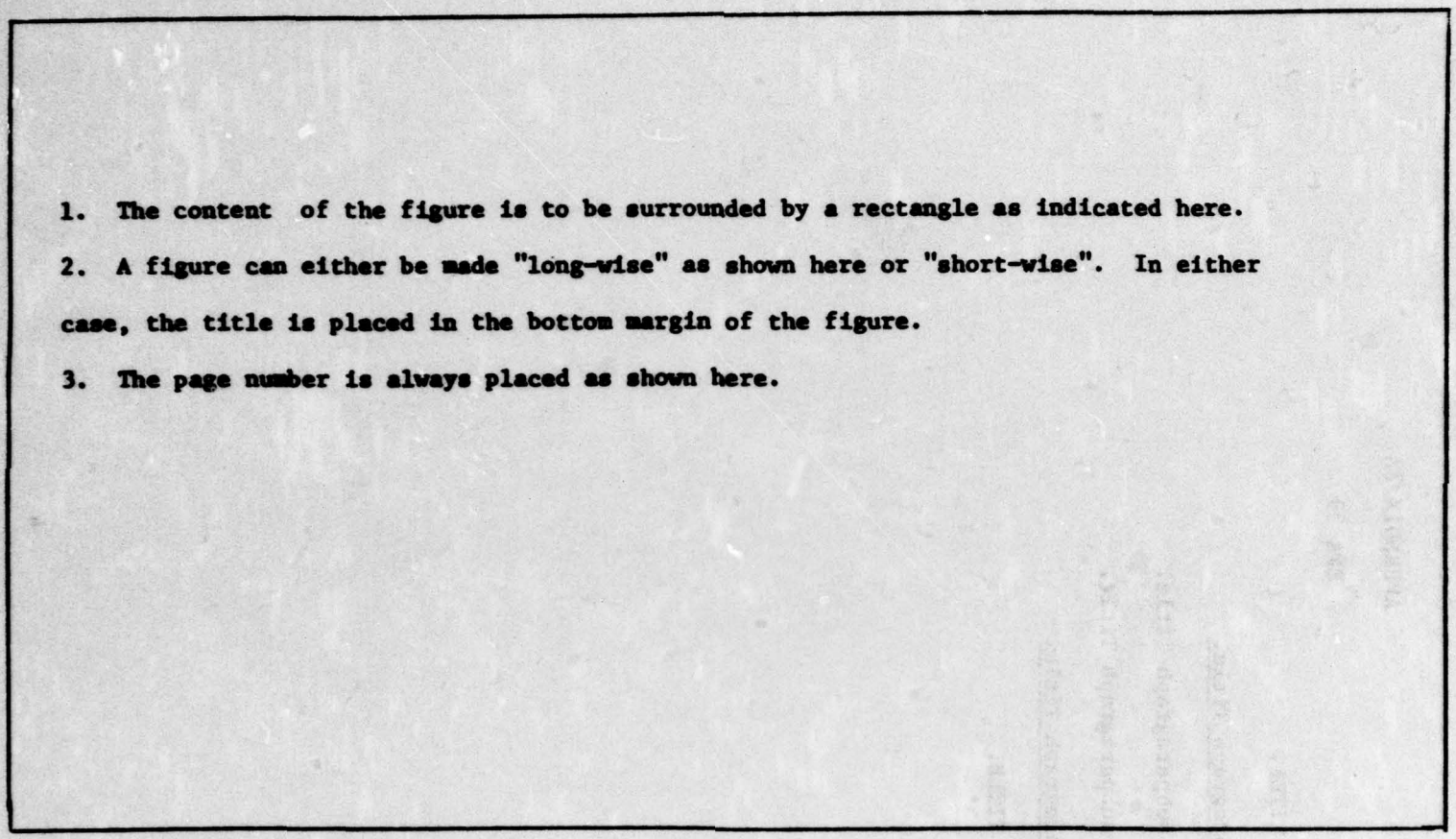


Figure M-I-b-3-5. An Example of a Figure.

M-I-b-3-9

EXAMPLE